

REMARKS

Summary

This Amendment is responsive to the Office Action mailed on November 18, 2003. Claims 5-21, 58, 61 and 62 are amended. Claim 60 is cancelled. Claims 2, 3, 22-42 and 59 have been withdrawn from consideration. Withdrawn claims 2, 3, and 59 are also amended herein so that they are in condition for allowance upon the allowance of a generic claim.

As discussed with the Examiner on February 13, 2004, Applicants respectfully submit that claim 58 is a generic claim, as it does not specify whether the molding compound is poured into the housing before or after the carrier is inserted. Dependent claim 61 specifies that the molding compound is introduced into the housing and then the carrier is inserted into the molding compound, while withdrawn dependent claim 59 specifies that the carrier is inserted into the housing and then the molding compound is poured around the carrier. Therefore, Applicants respectfully submit that claims 2, 3, and 59 should not have been withdrawn by the Examiner, and requests reconsideration of the withdrawal of these claims. Further, upon the allowance of generic claim 58, it is noted that Applicants will be entitled to consideration of claims to additional species which are dependent on or otherwise contain all the limitations of the generic claim (i.e., claims 2, 3, and 59).

The Examiner has objected to the title of the specification. The specification is amended herein to adopt the title suggested by the Examiner. Withdrawal of the objection to the specification is respectfully requested.

Claims 5-21, 61, and 62 is objected to due to informalities in the claim language. The claims are amended herein to overcome the informality objections, withdrawal of which is respectfully requested.

Claims 20 and 21 stand rejected under 35 U.S.C § 112, first paragraph, as failing to comply with the written description. In particular, the Examiner indicates that the term "complementary fixing means" in line 3 of claim 20 is not disclosed in the specification. Applicant respectfully submits that the subject matter of claims 20 and 21 is disclosed, for example, in Applicants' specification on page 10, paragraphs 2 and 3. Paragraph 2 of Applicants' specification specifies "It is particularly advantageous when the cap is provided with a fixing means and the connection element with a fixing means adapted thereto" (emphasis added). A fixing means on the connection element which is adapted to the fixing means of the cap is a complimentary fixing means. Examples of such complementary fixing means are provided in the remainder of paragraph 2 and the paragraph 3, such as a tongue on the cap and a corresponding notch for the tongue in the connection element. Therefore, Applicants' submit that the subject matter of claims 20 and 21 is adequately disclosed in the specification.

Claim 11 stands rejected under 35 U.S.C. § 112 as being indefinite. Claim 11 is amended to overcome the rejection under 35 U.S.C. § 112.

Withdrawal of the rejections under 35 U.S.C. § 112 is respectfully requested.

Claims 58 and 5-21 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Gass (US 5,789,920) in view of Harris (US 4,456,834).

Claim 9 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Gass in view of Harris and Sauer (US 5,602,373).

Claims 18 and 19 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Gass in view of Harris and Gass (DE 19504608).

Claims 61 and 62 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Grass in view of Harris and Guillot (US 5,749,143).

Applicants respectfully traverse these rejections in view of the comments which follow.

Discussion of Amended Claims

Claims 5-21, 61 and 62 are amended to overcome the Examiner's rejections under 35 U.S.C § 112.

Claim 58 is amended to clarify that the electrical connection element and the carrier form a carrier-connection element combination, in order to provide proper antecedent basis for the term "carrier-connection element combination" in certain dependent claims.

Claim 58 is also amended to include the subject matter of withdrawn claim 60 and now specifies that the molding compound is poured into the housing from the open rear end. Claim 60 is cancelled to avoid duplication of claimed subject matter. It is Applicants' understanding that new claim 60 was withdrawn from consideration by the Examiner as it depended from claim 59, which contains subject matter identified by the Examiner as belonging to Species A. However, the subject matter of claim 60 was not previously identified as belonging to Species A. Therefore, Applicants respectfully submit that the inclusion of the subject matter of claim 60 in claim 58 is in accordance with Applicants' election of Species B.

Withdrawn claims 2, 3, and 59 are also amended herein so that they are in condition for allowance upon the allowance of generic claim 58. In particular, claims 2, 3, and 59 are amended to overcome a potential objection as to an informality in the claim language, similar to the Examiner's objection to claims 5-21, 61, and 62.

Discussion of Applicants' Invention

In accordance with Applicants' invention as set forth in claim 58, a housing with a closed front and in an open rear end is provided. A carrier with an electrical circuit thereon is introduced in the open rear end of the housing. A molding compound is poured into the housing for encapsulating the electric circuit with a housing. An electrical connection element is provided on the carrier to enable an external connection to the electronic circuit. The carrier can be introduced before pouring the molding compound into the housing (as set forth in withdrawn claim 59) or the molding compound can be poured into the housing before inserting the carrier (as set forth in claim 61).

Applicants' inventive process offers a series of advantages: not only is the carrier and with it the circuit fixed in the interior of the housing as a result of the molding compound, but also a connection element for closing the interior of the housing at the measuring end and the cap are fixed in relation to the housing. Therefore, no further steps need to be taken to fix the connection of the carrier with the closure element at the measuring end. The molding compound serves not only to completely encase the circuit but also for fixing the components of the position sensor on the housing (see, e.g., Applicants' specification, paragraph bridging pages 2 and 3).

As a result of the fact that the carrier with the electrical connection element (carrier-connection element combination) is introduced into the housing from the open rear end of the housing and molding compound is poured into the open rear end of the housing, a relatively large opening space is available for the introduction of the carrier as well for pouring in the molding compound. Therefore, the carrier can be introduced into the housing quickly and without any difficulty and the filling procedure may be carried out quickly and concertedly since

molding compound need not be pressed in, in particular, via narrow channels. As a result, homogenous distribution of the molding compound may be achieved while avoiding air pockets. As a result, the position sensor produced in accordance with Applicants' method has a high dielectric strength and therefore a high safety classification.

The carrier-connection element combination may be fixed in the housing due to the subsequent placement of the cap, namely, transversely to a longitudinal direction of the housing, wherein this fixing is brought about automatically with a connection to the cap. Since the connection element is already connected to the carrier element, production of the position sensor is finished once the cap has been placed in position and the molding compound has hardened. In particular, the connection element does not have to be connected to the carrier in addition once the cap is already in place.

Since the carrier is connected to the connection element in a mechanically stable manner, the cap may be used for centering and fixing of the carrier via the carrier-connection element combination. As a result, a homogenous distribution of the molding compound is ensured and thus a high dielectric strength is achieved.

The housing may be designed in a cost-saving manner since no tapering to form a receiving means or the fixing of a connection element is required, since this task is attributed to the cap.

Due to the molding compound being poured in from the open rear end, a high safety class for the position sensor can also be achieved since a defined air path for preventing any breakdowns or damage is made available in a controlled manner, namely by controlling the amount of molding compound poured in and thus the level of the molding compound. By arranging a shrinkage tube to the air path, the dielectric strength may also be ensured with respect to the space free from molding compound (see, e.g., Applicant's specification, pages 3-4).

Discussion of Gass and Harris

Gass discloses a manufacturing method for a sensor (col. 6, line 57 to column 7, line 17). First, a sensor element 30 and a first part 16a of a carrier 16 with an electrical circuit are embedded in a molding compound 40. This embedding takes place outside of a housing 12. The molding compound 40 is a duroplastic molding compound (column 6, lines 57 to 60). The resulting unit is inserted into the housing 12 from the front end (see figure 1). Since a seal 44 is arranged in an intermediate space 42 between the molding compound 40 and the interior of the housing 12, the insertion direction of the carrier can only be from the front end (see, e.g., col. 6, lines 64-66). Subsequently, the intermediate spaces between a second part 16b of carrier 16 and housing 12 as well as between connection element 50 and the housing are filled with a thermoplastic molding compound 60 by injection molding (col. 6, line 66 to col. 7, line 3).

Gass therefore does not disclose or remotely suggest that a housing is provided with a closed front and an open rear end, as claimed by Applicants. On the contrary, the front end of the housing of Gass is open. Further, the carrier of Gass is not introduced into the open rear end of the housing but into the open front end. Also, in the process disclosed in Gass, an embedding step takes place before introducing the carrier into the housing. With the Applicants' claimed invention, such an embedding step outside of the housing is not necessary.

Further, with Applicants' claimed invention the molding compound is simply poured into the housing from the open rear end to encapsulate the electronic circuit within the housing. In contrast, the procedure of Gass requires injection molding, which has the disadvantages mentioned above.

As acknowledged by the Examiner, Gass does not disclose that the open rear end of the housing is capped with a cap, as claimed by Applicants. The Examiner relies on Harris as disclosing a cap.

Harris discloses a proximity switch. For manufacturing this proximity switch a coil 16 is first positioned in an end cap 14 and is secured in position and potted by epoxy resin 32 (col. 2, lines 38-40). As a result, the coil and end cap form a monolithic unit which can be handled during the remaining assembly operations easily and conveniently and without risk of damaging or displacing the coil (col. 2, lines 49-53). An adhesive is applied to the periphery of the end cap 14 and the assembly is introduced in the housing 10 until the cap 14 is a push fit in the end of the housing (col. 3, lines 34-38). Therefore, the carrier of Harris is introduced into the front end of the housing. The proximity switch is then filled with a two component transparent epoxy resin and a metal cap 26 is put in place (col. 3, lines 38- 39).

As indicated above, Harris does not disclose or remotely suggest that a housing with a closed front end and an open rear end is provided, as claimed by Applicants. Contrary to Applicants' claimed invention, Harris discloses a sensor with an open front end and an open rear end.

Further, the electrical connection element of Harris (wires 40, 42; col. 2, lines 65-66) is not fixed on the carrier in such a manner that a carrier-connection element combination is provided which can be handled as a unit, as claimed by Applicants. As a result, it is difficult to guide the wires 40, 42 through the cap 26 of Harris. Applicants' claimed invention, which provides a carrier-connection element combination, overcomes this disadvantage of Harris.

Further, Harris does not disclose or remotely suggest that the carrier is introduced into the open rear end of the housing, as claimed by Applicants. The carrier of Harris is inserted into the open front end of the housing. With Applicants' claimed

invention, the pouring of the molding compound into the open rear end of the housing is very easy. Since the front end of Applicants' housing is closed, and the carrier can be moved inside the housing during filling in such a way that the opening for filling is larger than in the method of Harris. If in accordance with Applicants' claimed invention the carrier is put in first and then the molding compound is poured in, during filling the carrier can be moved to the side for providing a larger opening. If the carrier is inserted into the housing after filling, filling is also very simple. With the methods of Gass and Harris, the carrier is already positioned in the housing in its final position and therefore the opening for pouring in a molding compound is quite small. Therefore, for example, Gass must use injection molding.

Applicants respectfully submit one skilled in the art would not have arrived at Applicants' claimed invention by combining the disclosures of Gass and Harris as proposed by the Examiner. Neither Gass nor Harris disclose or remotely suggest providing a housing with a closed front end and an open rear end as claimed by Applicants. Accordingly, Neither Gass nor Harris disclose or remotely suggest pouring in a molding compound into the housing from the open rear end, as claimed by Applicants. Similarly, neither Gass nor Harris disclose or remotely suggest introducing the carrier into the open rear end of the housing, as claimed by Applicants. Finally, neither Gass nor Harris disclose or remotely suggest capping the rear end of the housing with a cap and guiding the connection portions of the electrical connection element through the cap at the rear end, as claimed by Applicants.

Applicants respectfully submit that the present invention would not have been obvious to one skilled in the art in view of Gass in combination with Harris, or any of the other references of record.

Withdrawal of the rejections under 35 U.S.C. § 103(a) is

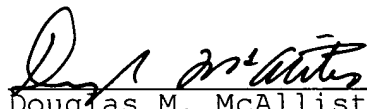
therefore respectfully requested.

Further remarks regarding the asserted relationship between Applicants' claims and the prior art are not deemed necessary, in view of the above discussion. Applicants' silence as to any of the Examiner's comments is not indicative of an acquiescence to the stated grounds of rejection.

Conclusion

In view of the above, the Examiner is respectfully requested to reconsider this application, allow each of the presently pending claims, and to pass this application on to an early issue. If there are any remaining issues that need to be addressed in order to place this application into condition for allowance, the Examiner is requested to telephone Applicants' undersigned attorney.

Respectfully submitted,



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